

REMARKS

By this amendment, claims 14, 16-21, 28, and 30-35 have been amended. Thus, claims 14, 16-21, 28, and 30-35 are now active in the application. Reexamination and reconsideration of the application are respectfully requested.

In items 1 and 2 on page 2 of the Office Action, the Examiner indicated that the use of the term “Hale-machining” causes the claims to fail to comply with the requirements of 35 U.S.C. 112, second paragraph. So as to obviate this concern raised by the Examiner, the term “hale-machining” has been changed throughout the claims to “non-rotating-tool machining.” This new phrase clearly describes the general nature of Hale-machining and is clearly supported in the specification and drawings, as well as the independent claim itself. For example, prior to the present amendment, claim 14 recited “Hale-machining ... by moving ... a non-rotational blade ...”. Similarly, in the original specification at, for example, page 8, line 26 - page 9, line 5, it was stated that the side faces 1C and 1D of wrap 1B “are hale-machine by non-rotational tool 9” and that “[n]on-rotational tool 9 ... [is] a Hale tool ...”. In addition, the Examiner’s attention is directed to U.S. Patent 7,089,836 which describes hale-machining using a haling tool that does not rotate. The Examiner’s attention is also directed to the concurrently-submitted publication by T. Ito et al. “A development of CAM system for non-rotating TOOL and multi axes,” which specifically describes hale machining as being non-rotating tool machining. In this regard, reference is made to the abstract which states “[t]o produce die/mold consisting of smooth curved surfaces by hale (non-rotating tool) machining ...”.

Next, in items 8 and 9 on pages 9 and 10 of the Office Action, claims 14, 16-21, 28 and 30-35 were rejected on the grounds of non-statutory obviousness-type double patenting as being unpatentable over claim 6 of U.S. 7,293,945. As an expedient, Applicant submits herewith a terminal disclaimer to overcome this obviousness-type double patenting rejection.

Next, in items 3-7 on pages 2-9 of the Office Action, claims 14-18, 22-24 and 28-32 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop (WO 89/08522); claims 19, 25 and 33 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop; claims 20, 26

and 34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop; and claims 21, 27 and 35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bishop in view of Niwa et al. (U.S. 4,615,091). These rejections are respectfully traversed, and it is respectfully requested that these rejections be withdrawn, for the following reasons.

Present independent claim 14 sets forth a machining method for a scroll wrap, wherein a side face (1B-1D) of one of a stationary scroll wrap and a slewing scroll wrap is non-rotating-tool machined by moving a non-rotational blade along a longitudinal direction of the wrap, and that this machining is carried out such that, in one pass of the non-rotational blade along the longitudinal direction of the wrap, substantially an entire height of the side face of the wrap is machine. As further specified in claim 14, this single pass machining with the non-rotational blade is carried out with a cutting edge of the non-rotational blade having a length greater than the height of the wrap.

In contrast to the present invention of claim 14, and as apparently recognized by the Examiner, the Bishop reference discloses machining of a scroll using a non-rotational blade, but does not disclose such non-rotational-tool machining in a single pass for substantially the entire height of the side face of the scroll wrap. Rather, Bishop describes that the non-rotating tool of the side surface of the wrap involves “(c) bringing a cutting tool into contact with a point on the surface of the wrap; (d) simultaneously traversing the tool in a direction tangential to the base circle ... whereby a strip of material is removed from the wrap over its full length; (e) removing the tool axially from the wrap and bringing it into contact therewith at a point adjacent the first mentioned point and repeating; (d) [and] (f) repeating step (c) until the whole surface of the wrap is machined to leave a surface finish consisting of a series of smooth and continuous spiral surfaces lying side by side each of limited extension in the direction of said axis.” (See page 4, line 26 - page 5, line 13 of Bishop). In fact, the repeating of the cutting at different axial locations of the side surface of the wrap in Bishop is described as being carried out “in a series of cuts ...” and that “up to 100 cuts will be required” (see page 5, lines 14-22 of the Bishop reference).

Since the Bishop reference clearly discloses that the non-rotating-tool machining in Bishop cannot be carried out in one pass over substantially the height of the wrap, the Examiner takes the position that “it would be obvious to one of ordinary skill in the art to machine the entire height of the stationary and slewing scroll wrap at one time by using two cutting tools in the machining of the scroll wraps of Bishop, in order to reduce the machining time and improve the tolerances on the machined scroll wrap by reducing the deflecting stresses caused by machining.” (See page 7, lines 2-6 of the Office Action). To support this conclusion of obviousness, the Examiner points to Bishop’s disclosure that end milling is performed in a single pass with the cutting tool having a greater length than the height of the wrap (see page 6, lines 16 and 17 of the Office Action). The Examiner notes that the Bishop reference mentions that multiple passes of a non-rotational tool are necessary because a single pass produces great forces on the scroll wrap which tend to deflect the scroll wrap during machining, and also notes that Bishop discloses that two tools cutting at one time reduces the deflecting forces substantially to zero (see page 6, lines 5-8 of the Office Action). The Examiner reasons, then, that since Bishop has found a way to reduce the deflecting forces substantially to zero by using two cutting tools at one time, it would have been obvious to a person skill in the art to modify Bishop’s multi-pass non-rotating-tool machining to be carried out in a single pass over substantially the entire height of this wrap.

This reasoning by the Examiner apparently fails to consider that, despite having recognized a way to reduce undesirable deflection by using two cutting tools at one time, and recognizing the desirability of performing non-rotating-tool machining, Bishop does not take the next step (which has only been suggested by the Examiner after reviewing Applicant’s disclosure) of performing the non-rotating-tool machining in a single pass; the only single-pass machining disclosed in Bishop is that performed using end milling.

In the last two lines of page 6 of the Office Action, the Examiner poses the question “[W]hat is different from the Applicant’s tool that resolves the issue of deflection while machining?” First in this regard, it is noted that the Bishop reference describes the deflection as

a disadvantage, but does not state that this disadvantage made such machining impossible. Furthermore, the discussion of the deflection problem of the wrap in Bishop was a discussion of “deleterious effects of the end milling process” with the cutter engaged with the wrap for its full depth before machining, is not the only disadvantageous effect mentioned in Bishop. Rather, this discussion in Bishop also describes the wrap formed in this manner as having a concavity along its length ... depending on the sharpness of the cutter which is continuously changing from piece to piece, and also that such machining is a problem because “such an end-mill cannot be sharpened on its outer cutting surface without loss of space width, and so has very limited life.” (See page 3, line 29 - page 4, line 12 of the Bishop reference).

Regarding a difference between the Applicant’s tool and that described in Bishop for carrying out non-rotating-tool machining, such a difference is clear from a review of the Bishop reference. Specifically, the non-rotating-tool machining being carried out in the Bishop reference utilizes the tools 11, 12 having tool points 13, 14. As can be seen, for example, in Figs. 5-7 of the Bishop reference, the tools 11, 12 utilized in the Bishop method are provided with the cutting tips (tool points) 13, 14 at the tip ends thereof, which are the tip ends that are in cutting engagement with the scroll wrap. It can be readily seen from Figs. 5-7 of Bishop that the tools 11, 12 are disposed, not vertically, but at an acute angle relative to the scroll wraps 4. Therefore, it would not be possible to use the Bishop arrangement shown in Figs. 5-7 of a non-rotating-tools 11, 12 to machine substantially an entire height of the side face of the wrap 4 in a single pass, unless the entire nature of the Bishop tools and tool utilization method were also revised. That is, attempting to utilize the tools 11, 12 of Bishop in the manner disclosed, but performing the machining of substantially the entire height of the side face of the wrap in a single pass would at least result in scroll wraps having non-vertical side faces, which clearly would be undesirable.

The Examiner also noted in the “Response to Arguments” section of the Office Action and, in particular, at page 11, lines 9-12 of the Office Action, that “Applicant has not disclosed why their machining process would produce different results than the prior art, BISHOP, when machining at one time the same scroll wrap (i.e., same material, same thickness, etc.) a portion of

the scroll wrap for the entire height of the scroll wrap.” In this regard, first, as discussed above, the Bishop machining process is not the same as that disclosed in the present application since the non-rotational tool of the present invention, as clearly seen in Fig. 2A, for example, is disposed vertically so as to cut parallel along the side face of the scroll wrap; whereas, in Bishop, the tools 11, 12 are disposed at an acute angle relative to the scroll wraps. Additionally, contrary to the Examiner’s assertion, Applicant’s specification clearly describes advantageous aspects of a particular machining as required by the present claim 14. In this regard, reference is made to the original specification at, for example, page 9, line 11 - page 11, line 11, wherein it is described that the present inventive method results in no swells in longitudinal direction or, if any such swells are present, the swells would be much smaller than would otherwise be the case. The surface roughness is also advantageously suppressed, thereby suppressing leakage of compressed gas. The single pass machining of the present invention also eliminates the time and adjustment required when a cutting machining process is divided into a plurality of steps. As a result, the machining accuracy is increased and the machining time is reduced, thereby allowing a low-cost scroll compressor to be manufactured. Further advantageous effects are set forth at page 12, line 12 - page 13, line 11, wherein it is described that the machining of the present invention can form machining marks 31 (see Fig. 2C). These machining marks 31 are described as significantly reducing the swells caused at the machined side faces of the wraps.

Therefore, for the above reasons, it is believed apparent that, not only does Bishop not disclose the particular features of the present inventive method, but also fails to include any suggestion that would have caused a person having ordinary skill in the art to have found it obvious to modify the Bishop method to result in the present invention of independent claim 14.

The Examiner cited the Niwa et al. patent for disclosing “a cutting edge that depending on the amount of indexing would result in the desired size and finish (column 1, lines 44-65).” However, any such disclosure in the Niwa et al. patent clearly would not have obviated the above-discussed shortcomings of the Bishop patent.

Therefore, in view of the above discussion, it is believed apparent that present claim 14

would not have been obvious to a person of ordinary skill in the art in view of the prior art cited by the Examiner. Therefore, it is respectfully submitted that claim 14, as well as claims 16-21, 28 and 30-35 which depend therefrom, are clearly allowable over the prior art of record.

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice thereof is earnestly solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, it is respectfully requested that the Examiner contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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